

HANFORD
SITE PROFILE

December 1999

**Office of Oversight
Environment, Safety and Health
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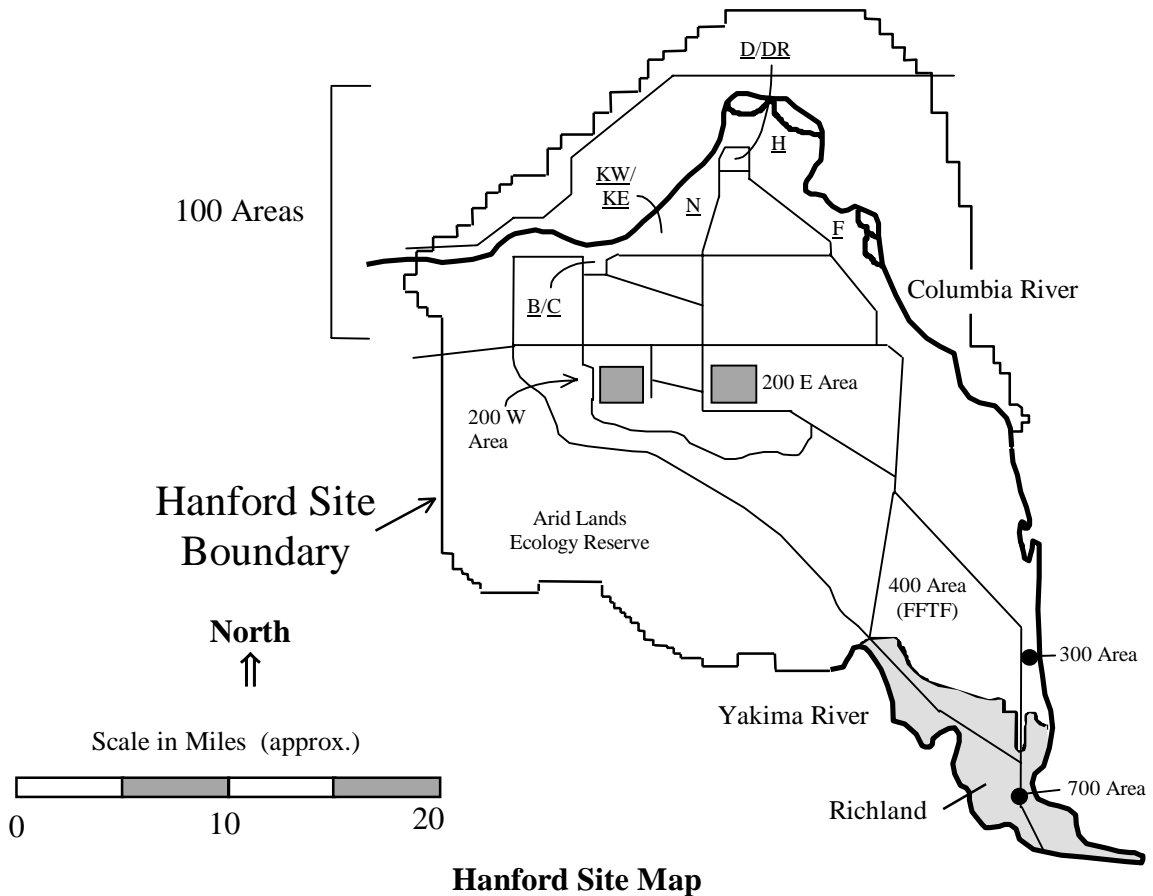
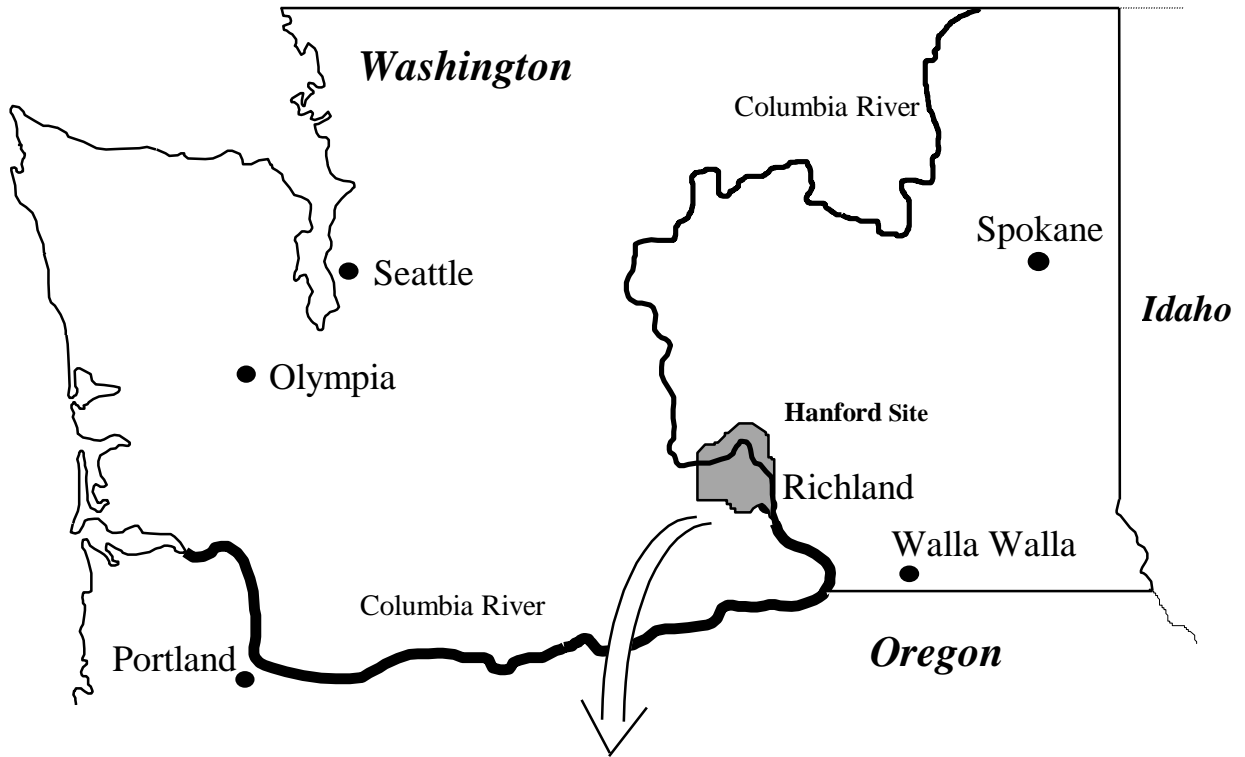
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Site profiles provide information on Department of Energy sites, including background; major environment, safety, and health initiatives and activities; items for management attention; and performance.

The electronic version of this site profile and other Office of Oversight documents referenced in this document can be accessed through the Internet at **<http://tis.eh.doe.gov/oversight/bookcase2>**.

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HANFORD SITE

This profile does not include information on the Pacific Northwest National Laboratory, which is addressed in a separate profile.

BACKGROUND

Description

The Hanford Site (358,388 acres, 560 square miles) is located in southeastern Washington state just north of Richland. It is bordered on the east by the Columbia River and on the south by the Yakima River and the City of Richland. The site was established in early 1943 by U.S. Manhattan Engineer District (Army Corps of Engineers) to build the first full-size reactors to produce plutonium for nuclear warheads.

The Hanford Site is divided into several areas, each designated for specific types of facilities and activities. At the north end of the site, nine old plutonium production reactors are located in the 100 Areas, which are situated along the Columbia River. All nine of the reactors have been retired and deactivated. The N Reactor has been recently moved to surveillance and maintenance status. The C Reactor has recently completed interim safe storage activities, which meets a Tri-Party Agreement milestone. Chemical processing, waste management facilities, and high-level waste tank farms are concentrated in the 200 East and West Areas, located in the center of the site. The 300 Area, located in the site's southeast corner, contains

laboratories, technical shops, engineering offices, and support facilities that focus on research and development (R&D) associated with waste management and energy technologies. The 400 Area, northwest of the 300 Area, includes the Fast Flux Test Facility (FFTF), which is a defueled, sodium-cooled fast flux test reactor in standby status.

The site's key facilities are described in Appendix A. Each facility's description includes its mission/status, hazard classification/authorization basis, worst case design basis accident, and principal hazards and vulnerabilities. For the purpose of the profile, a key facility is a facility, building, or complex that is significant from an environment, safety, and health perspective.

Mission

The original Hanford mission was the production of plutonium for national defense. The current mission focuses on environmental restoration, waste management, and related scientific and environmental research.

Management

The cognizant secretarial office is the Office of the Assistant Secretary for Environmental Management (EM). Table 1 lists the principal EM offices.

Table 1. Principal EM Offices

Cognizant Secretarial Office - Office of the Assistant Secretary for Environmental Management (EM)	
Office of Project Completion (EM-40)	
Richland Office (EM-43)	
Environmental Restoration and Waste Management Team	Spent Nuclear Fuel and Nuclear Materials Team
Office of River Protection (EM-44)	
Storage and Retrieval Team	Processing and Disposal Team

Contractor activities are managed by the Department of Energy (DOE) Richland Operations Office (RL) and the Office of River Protection (ORP). Approximately 10,000 people work at the site as of January 1999. This number includes approximately 400 RL employees and 100 ORP employees and approximately 3,500 employees of Pacific Northwest National Laboratory (PNNL). These numbers do not include Enterprise Companies (EnCo) employees at Hanford (see Table 2). Contracts let under the Project Hanford Management Contractor (PHMC) Team contract are performance-based, designed to pay fees only if the contractor achieves certain designated results. As the PHMC Team management and integration contractor, Fluor Daniel Hanford, Inc. (FDH), has committed to four major milestones:

- Stabilize plutonium by December 2004, and reduce associated hazards
- Complete removal of fuel, sludge, and debris in the K-basins by June 2007

- Control, clean, and stabilize two high-level radioactive waste tank farms by December 31, 2001
- Deactivate weapons production plants by 2005.

The contract value for the initial five-year period is \$4.88 billion, with a \$4.68 billion five-year option.

The PHMC Team and other major contractors are shown in Table 2, along with their functions at the Hanford Site. Several provisions of the PHMC contract are consistent with the contract reform initiative: the use of an integrated approach to include environment, safety, and health (ES&H) in all activities; selection of an ES&H-qualified contractor; implementation of the ES&H planning process; flowdown of ES&H requirements to subcontractors; and change control of ES&H commitments. Projects under ORP are shown in Table 3. Figure 1 shows the relationships between EM, RL, ORP, and contractors on the Hanford Site.

Table 2. Hanford Operating Contractors Under Richland Operations

Fluor Daniel Hanford Inc. (FDH) Management and Integration Contractor (Contract with RL through March 2001)		Bechtel Hanford, Inc. (BHI)	Hanford Environmental Health Foundation (HEHF)	Battelle Memorial Institute (BMI)	Johnson Controls, Inc. (JCI)
Management Team		<p>Principal responsibility for environmental restoration and remediation activities.</p> <p>BHI is responsible for planning, managing, executing, and integrating the Environmental Restoration Project at the Hanford Site.</p> <p>Three-year contract extension through June 30, 2002.</p>	<p>Provides medical services to RL and contractor employees statewide.</p> <p>Three-year contract with two year possible extension.</p> <p>Effective contract, October 1998 through June 2001.</p>	<p>Serves in a sitewide technical support role in the environmental science and technology areas.</p> <p>Operates Pacific Northwest National Laboratory (PNNL) through the BMI, Pacific Northwest Division.</p> <p>Present contract through June 2002.</p>	<p>Performance-based contract. JCI pays all capital and operating costs to upgrade energy systems in 200 and 300 Areas for a fixed monthly rate.</p> <p>This is a 25-year contract.</p>
Waste Management Federal Services of Hanford, Inc.	Waste Management Project				
Duke Engineering & Services, Inc.	Spent Nuclear Fuel Project One-year extension to Sept. 30, 1999				
B & W Hanford Company (BWX Technologies, Inc.)	Facility Stabilization Projects				
Numatec Hanford Corporation	Technology Implementation and Nuclear Engineering				
Protection Technology Hanford	Safeguards & Security				
DynCorp Tri-Cities Services, Inc.	Infrastructure Support Services				
Enterprise Companies (EnCos)*					
Fluor Daniel Northwest, Inc. (FDNW)			Architect, Engineering, and Other Services		
COGEMA Engineering			Process Engineering and Technical Services		
Lockheed Martin Services, Inc. (LMSI)			Information Resource Management		
Waste Management Federal Services, Inc., Northwest Operations (WMNW)			Waste Management and Environmental Services		

*Enterprise companies provide services throughout the Hanford Site. The goal of these companies is to transition workers from DOE contracts to non-DOE contract work.

Table 3. Hanford Projects Under the Office of River Protection

PROJECT	CONTRACTOR
Project for the Treatment and Immobilization of High-Level Waste a) Phase I Private Contractor b) Waste Treatment c) Waste Immobilization	BNFL, Inc., team: Bechtel National Inc., GTS Duratek, and Science Applications International Corporation (SAIC)
PHMC River Protection Project (RPP) a) Waste Characterization b) Interim Stabilization c) Tank Farms Surveillance & Maintenance d) Waste Feed Retrieval and Delivery e) Immobilized Waste Storage and Disposal f) Tank Farm Closure	FDH/Lockheed Martin Hanford Corporation
Waste Management Project relating to RPP a) 242-A Evaporator Operations b) 222-S Laboratory Operations c) Effluent Treatment Disposal d) Solid Waste Services	FDH/Waste Management Federal Services of Hanford, Inc.
Spent Nuclear Fuels Project as related to the Canister Storage Building Design/Construction for use by RPP	FDH/Duke Engineering & Services, Inc.
Infrastructure Services relating to TWRS a) Roads b) Electricity c) Water	FDH/DynCorp Tri-Cities Services, Inc. FDH/Wilson Construction Co., Richland, WA. (Electrical substation construction) FDH RCI Environmental, Inc.
TWRS Technology Development	PNNL
Vadose Zone Integration relating to RPP	PNNL & BHI
Groundwater Evaluations relating to RPP	PNNL & BHI

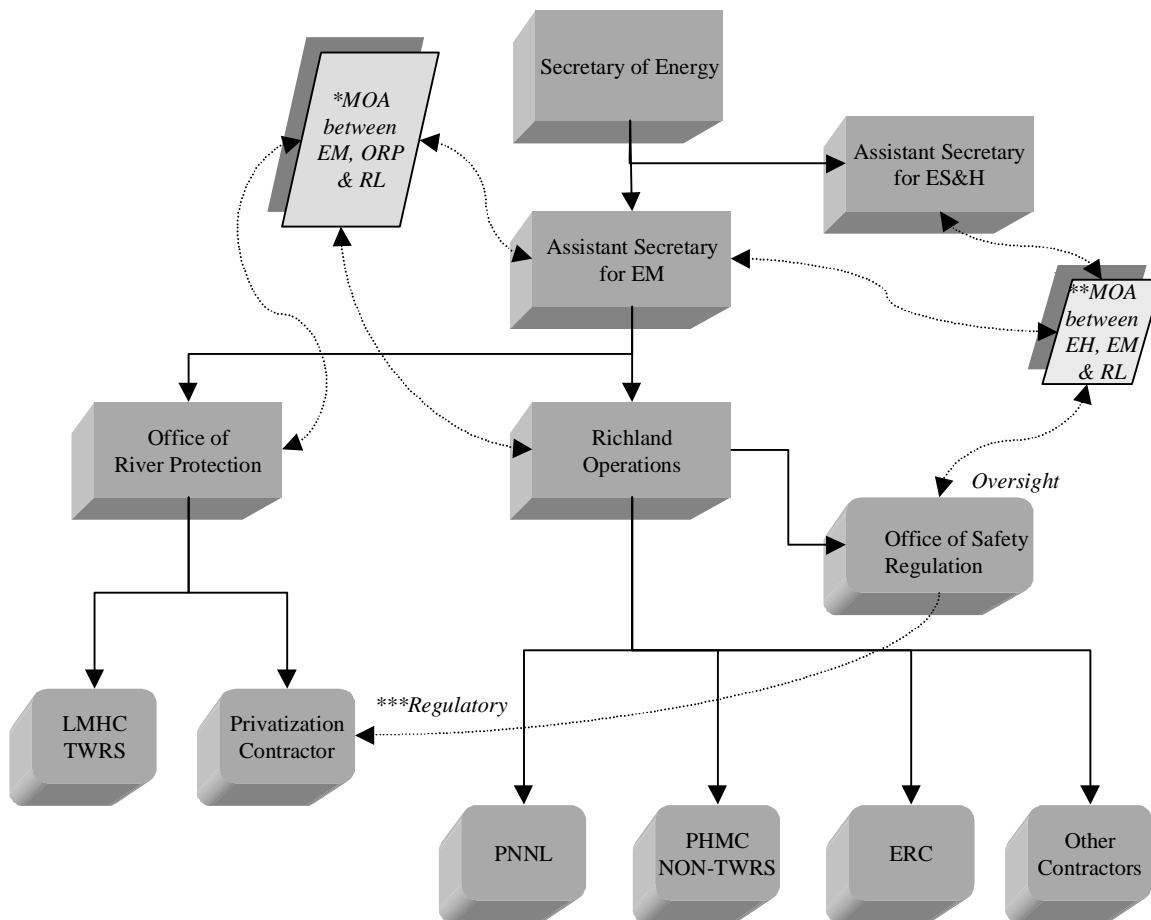
Office of River Protection

The Office of River Protection, formerly under Richland Operations and known as the Tank Waste Remediation System (TWRS), was established as a separate operation reporting directly to EM in December 1998. As directed by Congress in Section 3139 of the Strom Thurmond National Defense Authorization Act for FY 1999, DOE established ORP to focus management responsibility and accountability. Figure 1 shows the relationships among the DOE Headquarters, field, and contractor organizations. The two memoranda of agreement (MOAs) shown in Figure 1 define the important organizational relationships necessary to properly and safely perform the TWRS project:

- Memorandum of Agreement among EM, RL, and ORP- This MOA establishes an agreement regarding ORP's organizational authorities, roles and responsibilities, and reporting

structure. This document was last revised in August 1999.

- Memorandum of Agreement for the Execution of Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors, DOE/RI-96-26, Revision 0, Dated July 3, 1996 - This MOA is responsive to the Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors, providing the details of interactions among the RL Manager; the Assistant Secretary for Environmental Management (EM-1); and the Assistant Secretary for Environment, Safety and Health (EH-1) for discharge of the responsibilities associated with the regulatory program for TWRS privatization contractors. The MOA provides a basis for key DOE officials to commit to teamwork in implementing the policy's objectives, principles, framework, and elements, and in ensuring adequate safety of TWRS privatization activities.



* Memorandum of Agreement (MOA) between EM, RL and ORP. Latest Revision, August 1999.

** EH Oversight requirements established by July 1996 MOA for TWRS Privatization Project.

*** Regulatory group overseeing TWRS Privatization Project

Figure 1. EM, RL, ORP Organizational Chart

ORP oversees Hanford Sites RPP, consisting largely of the former Tank Waste Remediation System (TWRS), which is a large and complex effort to remediate 60 percent (by volume) of the nation's and 80 percent (by radioactivity) of the Hanford Site's radioactive waste resulting from nuclear weapons development. It includes remediating approximately 190 million curies in 54 million gallons of liquid and solid waste that have been accumulating in underground storage tanks for more than 50 years and 143 million curies in cesium and strontium capsules.

Office of River Protection Privatization

ORP has selected privatization as the approach to procure waste treatment services for Hanford tank waste. Under this approach, contractors finance, design, permit, construct, operate, and deactivate treatment facilities and will receive payment for successfully treated tank waste. The entire project consists of two phases:

- Phase I will demonstrate the business, technical, and regulatory viability of privatizing the tank waste treatment scope.

- Phase II will complete processing of the tank waste by 2028.

In September 1996, a contract was awarded to BNFL, Inc., to treat and immobilize Hanford's tank waste (Phase I). Part A of the contract involved establishing the technical, operational, regulatory, business, and financial elements required to establish fixed prices. Part B involves completing design, permitting, construction, operation, and deactivation.

In August 1998, DOE completed negotiations with BNFL, Inc. BNFL, Inc. is now authorized to proceed to Part B to treat and immobilize high-level waste from Hanford's tank farms.

Part B has been broken into Parts B-1 and B-2 to allow project risks to be better understood prior to establishing fixed prices:

- Part B-1 is a 24-month period that will optimize the treatment and immobilization system, complete approximately 30 percent of the design, reduce contingencies, finalize fixed prices, and reach financial closure. Part B-1 is worth approximately \$350 million.
- Part B-2 will complete design, construction, operation, and deactivation of the treatment and immobilization facility for a fixed price per unit of waste processed. Facility operation will begin around 2006 and be complete in 2018.

Part B has a target price of \$6.9 billion (1997 dollars) to treat approximately 10 percent of the Hanford tank waste based on chemical inventory and 25 percent based on radionuclide inventory. The completed facility will have a 30-year design life, rather than the DOE's initial concept of a five- to nine-year demonstration facility.

Contract For Electrical Substation And Lines To Support Waste Vitrification

A \$7.6 million contract has been awarded to initiate construction support work for the future tank waste treatment and vitrification facilities at the Hanford Site. FDNW has awarded the first phase of a design/construction contract to build

an electrical substation and power transmission lines. The electrical power will supply the waste treatment and vitrification facilities that are being designed and will be constructed by BNFL, Inc.

A team led by Wilson Construction Co. of Richland, Washington, has the contract and has initiated a series of activities that will build the infrastructure needed by the massive vitrification facilities that will be constructed to begin treatment of Hanford's high-level tank waste. However, DOE site contractors will manage construction of the power supplies, roads, water lines, and liquid effluent lines connecting the treatment and vitrification facilities to other Hanford facilities.

The 62-megawatt electrical station will be among the most powerful in the region, and will supply power to the waste treatment and vitrification facilities via 3.5 miles of 230-kilovolt transmission lines. Additional contracts will be awarded to clear the 55-acre vitrification site and construct connecting roads, water, and effluent lines. These infrastructure improvements are scheduled to be operational by April 2002. Lockheed Martin Hanford Corp., a subcontractor to FDH, is performing the project management services for this work. FDNW will provide the architect/engineering and construction management services for the infrastructure projects.

Second Infrastructure Contract Awarded to Support Hanford Tank Waste Treatment

On August 4, 1999, the PHMC team working for ORP awarded a design and construction contract for site preparation activities, roads and water utilities to support the planned waste vitrification facilities at the Hanford Site.

The contract, awarded to RCI Environmental, Inc., has a total value of \$3.54 million. The contract also includes the design and construction of the non-dangerous and radioactive dangerous liquid transfer systems from the waste treatment plant site to the effluent treatment facility managed by Waste Management Federal Services of Hanford, Inc.

Budget

The information appearing in this section has been gathered from a number of sources and represents the best available budget information at the time of profile publication. This information is dynamic, depending on the point in the budget cycle at which it is obtained. It is included to provide the reader with a sense of

the magnitude and sources of the budget for this site. It is not intended to be the definitive source of budget information. EM is the Hanford Site landlord. The Hanford Site budget was approximately \$1.5 billion for FY 1999, and approximately \$1.7 billion has been requested for FY 2000. Table 4 lists sources of program funding.

Table 4. Major Program Funding (In \$Millions)

Organization/Program	FY 1999 Actual	FY 2000 Request
Environmental Management	1,161	1,280
Office of Science	101	119
Defense/National Security Programs	85	80
Nuclear Energy	112	62
Work for Others	39	80
Energy Efficiency and Renewable Energy	24	23
Miscellaneous Programs	13	12
Total	1,535	1,656

Noteworthy budget items include the following.

Protection of the Columbia River

The DOE budget for FY 1999 includes \$1.5 billion for Hanford Site programs, including cleanup, tank waste treatment, and science and technology. The environmental management (or cleanup) portion of Hanford's proposed budget is about \$1.2 billion, with an additional \$106 million for the privatized tank waste treatment program. Hanford's FY 1999 budget provides for:

- Moving Hanford's spent nuclear fuel away from the river
- Initiating tank waste treatment
- Integrating vadose zone and groundwater issues
- Pumping and treating contaminated groundwater
- Stabilizing single-shell waste tanks and resolving tank safety concerns
- Remediating waste sites along the river and removing contaminated soil
- Sending transuranic waste off the Hanford Site
- Stabilizing plutonium solutions.

Significant Commitments to Stakeholders

Tri-Party Agreement

The Tri-Party Agreement (TPA) among the State of Washington Department of Ecology (WDOE), the Environmental Protection Agency (EPA), and DOE provides the framework and mechanisms to ensure that environmental impacts associated with past and present activities at the Hanford Site are properly characterized and to promote an orderly, effective cleanup of hazardous materials in accordance with applicable regulations, while avoiding litigation between the parties.

Hanford Advisory Board

The Hanford Advisory Board is a citizens' board formed to advise the TPA members (DOE, EPA, and WDOE) in the cleanup of nuclear waste and contamination at Hanford.

Hanford Health Effects Subcommittee

Hanford Health Effects Subcommittee (HHES) is a Federal Citizens' Advisory Committee established by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers

for Disease Prevention and Control (CDC). The subcommittee advises the two agencies on selecting and designing the agencies' public health research and activities related to Hanford. Presently, the HHES has 19 members and also receives input from governmental liaisons representing nine Native American tribes and the states of Washington, Oregon, and Idaho.

Defense Nuclear Facilities Safety Board (DNFSB) Recommendations

DNFSB recommendations specifically applicable to Hanford are shown in Table 5.

Table 5. Site-specific DNFSB Recommendations

DNFSB Recommendation	Subject	Status
92-4, <i>Multi-Function Waste Tank Facility At Hanford</i>	Recommends the development of a project plan to ensure that 1) the project design meets required quantitative Departmental safety goals, and 2) the project can be properly executed.	Hanford has adequately completed all deliverables under the current 92-4 implementation plan. The implementation plan deliverables demonstrate Hanford's ability to implement a systems engineering approach on ORP projects. A sitewide systems engineering process, including associated procedures, was developed and institutionalized in revision 1 of the implementation plan. ORP is drafting a package to propose closure of Recommendation 92-4.
93-5, <i>Hanford Waste Tank Characterization Studies</i>	Recommends a restructured tank characterization effort to accelerate safety-related sampling and analysis of priority tanks.	In July 1998, RL issued a letter reporting completion of the tank-by-tank safety status evaluations. The approved final safety analysis report (FSAR) was delayed beyond the target date of January 30, 1999. FDH transmitted the FSAR to RL on August 14, 1997. RL has completed the Tier II and Tier III review processes. The FSAR was approved in March 1999. ORP has identified funding and intends to initiate FSAR implementation activities during FY 1999.
94-1, <i>Improved Schedule for Remediation in Defense Nuclear Facilities</i>	Recommends that the program be accelerated to place the deteriorating reactor fuel in the K East Basin at the Hanford Site in a stable configuration for interim storage until an option for ultimate disposition is chosen. This program needs to be directed toward storage methods that will minimize further deterioration. Expedited preparations should take into account the need to meet the requirements for operational readiness in accordance with DOE Order 5480.31.	Under milestones proposed by the DOE-EPA agreement, fuel removal would start at the K West Basin on November 30, 2000, and from the K East Basin one year later. Other proposed milestones call for completion of the fuel removal by December 31, 2003, and completion of the K Basin cleanup (including the removal of sludge, debris, and water) by July 31, 2007.

MAJOR ENVIRONMENT, SAFETY, AND HEALTH INITIATIVES/ACTIVITIES

Spent Fuel Storage

About 2,100 metric tons of spent nuclear fuel will be moved from the aging K Basins into

storage away from the Columbia River. The approach selected and documented in the record of decision for the K Basin environmental impact statement (EIS) is dry storage in multi-canister overpacks in a canister storage building. Fuel removal from the K Basin is now scheduled to start on November 30, 2000, with completion by December 31, 2003. DOE and the EPA have agreed to enforceable milestones.

Environmental Restoration

The Hanford Site includes four designated Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priority List (NPL) locations that contain over 1,600 waste sites. The Richland Environmental Restoration (RLER) project is responsible for the remediation of over 1,400 of these sites. The strategic goals of the RLER project are to protect the Columbia River, contain 200 Area groundwater plumes, remediate the 100 Area source units and groundwater, remediate 100 Area facilities, and restore and consolidate wastes in the 200 Areas/Central Plateau.

Ongoing RLER activities include groundwater treatment; stabilization of surface contamination; excavation of contaminated soil; decontamination and decommissioning of various facilities; and relocation of highly radioactive fuel components away from the Columbia River.

Waste Management

Waste Receiving and Processing (WRAP-1) facility (Building 2336-W) construction was completed in March 1996. The facility began operating its non-destructive evaluation/non-destructive assay (NDE/NDA) lines on March 17, 1997. An operational readiness review was performed for the glovebox operations by RL in August 1998, and the facility began these operations on September 17, 1998. The purpose of the 2336-W operations is to certify and characterize low-level and transuranic waste to meet disposal criteria prior to storage or disposal. Small quantities of radioactive mixed waste will be thermally treated and stabilized at onsite and offsite facilities to meet Resource Conservation and Recovery Act (RCRA) low-level mixed waste requirements for disposal in trenches at Hanford. Transuranic waste shipments to the Waste Isolation Pilot Plant (WIPP), in New Mexico, are expected to start by the end of calendar year 1999. The volume of radioactive liquid effluent treatment at the 200 and 300 Area facilities will continue to increase as new feeds are identified and qualified.

Facility Transition/Decontamination and Decommissioning (D&D)

The facility transition program is a long-term program to deactivate several old weapons production and nuclear energy facilities. Facilities such as B Plant/Waste Encapsulation and Storage Facility (WESF), FFTF, and the Plutonium Finishing Plant (PFP) are being decontaminated to eliminate and/or stabilize hazardous materials. The B Plant met its goal of complete deactivation before the end of 1998. The facility will move into the mode requiring minimal long-term surveillance and maintenance. Once a facility has been placed in a safe, stable state and a final budget and closure plan for full D&D have been established, facility deactivation can begin.

High-Level Radioactive Waste Tanks

Tanks under the cognizance of ORP contain about half the curies (250 of 500 million) of radioactivity and mass of hazardous chemicals found on the Hanford Site. The high-level radioactive waste (HLW) is stored in 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs). Both types are covered with about 10 feet of soil and gravel and located in groupings called "tank farms" in the 200 West and 200 East areas of the site. The SSTs were built from 1943 to 1964 with a design life of approximately 30 years. The domes of the SSTs and DSTs are made of concrete without a steel inner liner. The DSTs were built from 1968 to 1986 with a design life of approximately 50 years. The air space between the inner and outer shells of DSTs is monitored for leaks.

The SSTs contain approximately 150 million curies of radioisotopes (mostly Cs-137 in saltcake and interstitial liquids, and Sr-90 in sludge). Of the older SSTs, 67 have leaked or are assumed to have leaked a total of approximately one million gallons of wastes (containing approximately 1.2 million curies of radioisotopes) into the ground.

Failure of the steel liner or concrete dome of the SSTs could release large volumes of HLW to the environment, thereby posing a serious health risk

to workers and possibly contaminating the groundwater and river system. Such a release would be difficult and costly to mitigate. History has shown that about one SST begins to leak each year.

An ORP SST project is under way to use interim stabilization and intrusion prevention to minimize the amount of HLW that can leak from SSTs. Interim stabilization of SSTs (the removal of pumpable liquid from SST systems into DST systems) has been completed on 118 of 149 SSTs. Intrusion prevention, performed after interim stabilization, is the disconnecting and blanking or capping of pipelines from SST systems and installation of barriers to avoid inadvertent liquid addition.

New studies have confirmed that radioactive contaminants have leaked from SSTs at Hanford and have entered the groundwater. Two draft reports prepared for RL by PNNL concluded that mobile contaminants from some of the tanks are reaching groundwater under the site's 200 Area, which includes HLW tanks, as well as facilities that produced plutonium from 1944 until the late 1980s. DOE has known that some 100 square miles of groundwater underlying the 200 Area had been contaminated, but assumed that most, if not all, of the contamination was the result of past practices that permitted the disposal of hazardous and radioactive waste directly into ponds, trenches, and ditches at the site.

The PNNL reports examined contamination from leaking tanks at two tank farms, one in the 200 East Area and the other in the 200 West Area. Contaminated groundwater in the latter area is not expected to reach the river—some 15 miles distant—for about 100 years, while contaminated groundwater in the 200 East Area, five miles closer to the river, could reach the Columbia River in as few as 20 years. DOE currently has a number of pump-and-treat projects operating at Hanford aimed at preventing such contaminants as chromium (an element that is deadly to fish at very low levels), radioactive strontium, and carbon tetrachloride from reaching the river.

Consolidation of Vadose Zone Monitoring Program

On January 22, 1998, the Under Secretary of Energy committed DOE to addressing groundwater and soil contamination at Hanford to help protect the Columbia River. BHI will be responsible for managing the sitewide vadose and groundwater program. RL has created a new office under the Assistant Manager for Environmental Restoration to oversee this program.

Plutonium Stabilization at PFP

In October 1996, B&W Hanford Company (BWHC) was assigned the management of PFP under its subcontract with FDH. When BWHC took over the management of the plant, no facility management or employees were changed. A series of criticality infractions occurred under this staff over the last four months in 1996, culminating in an occurrence in December 1996. Investigation into the reasons for the infractions identified that safety procedures and training were inadequate. As a result, BWHC—with the concurrence of FDH and DOE—suspended operations at the facility until those safety issues were resolved. During suspension of those operations, a chemical explosion occurred on May 14, 1997, at the Plutonium Reclamation Facility (PRF), which is part of the PFP complex. Since then, DOE line management has provided intensive oversight of PFP activities, and BWHC has made substantial changes in their staff, procedures, and training.

Restart of plutonium oxide thermal stabilization operations occurred on January 15, 1999, and the first item to be stabilized after the two-year stand-down was completed on January 18, 1999. These operations were allowed to restart only after the plant's staff passed a rigorous operational readiness review. Two review teams, one from DOE and one from FDH, conducted the reviews. The DOE team identified a list of 15 pre-start findings that were resolved by the contractor and DOE before operations resumed. As of March 19, 1999, the facility had advanced to Phase 4 of the Restart Plan, during which RL oversight of the plutonium oxide stabilization activities can be reduced.

PFP holds 4 metric tons (MT) of scrap plutonium in 17 MT of plutonium-bearing materials in several forms including metal, powders, scraps, liquids, and polycubes. Approximately three-quarters of the plutonium will be stabilized using the muffle furnace process. This process converts chemically reactive plutonium-bearing scraps and powders into a safer form for storage by heating the material in small ovens called muffle furnaces at the maximum temperature of 1,000 C for two to four hours. This process drives out the moisture and volatile chemicals and converts it into impure, inert plutonium oxide that can be sealed in containers for long-term storage in PFP's shielded vaults. Other potential stabilization methods under evaluation are:

- A "vertical calciner" that will convert plutonium-bearing liquids into powder. A prototype has been tested, and this process could begin next year.
- A different type of oven that will convert other plutonium bound in polycubes. The technology is still being developed, and this process could begin in 2000.
- Material with low plutonium content will be mixed with cement. This process will be used when funding becomes available in approximately two years.

Return of the plant to full operations was conducted in two phases. Following procedural reviews, extensive retraining, and readiness reviews, much of the routine work at PFP resumed in May 1998. These activities include inventory control, laboratory analysis, vault operations, and waste management.

The second phase, thermal stabilization of plutonium-bearing materials, requires formal operational readiness reviews before operations can resume. The delay has caused the completion date for plutonium stabilization and packaging to be revised from May 2002 to December 2004.

Settling Tank 241-Z-361 at PFP

A review of chemical hazards after the May 14, 1997, PRF chemical explosion identified potential hazards with PFP's 361 Settling Tank. The tank contains approximately 50 kg of plutonium and organic chemicals. RL declared an unreviewed safety question on October 15, 1997, based on potential pressurization of the tank and deflagration due to volatile organic compounds and hydrogen gas. The justification for continued operation (JCO) was approved in February 1998. Venting of the tank was performed in April 1999. The tank is covered under CERCLA regulations. Funding for the tank is currently adequate to meet its sampling objectives.

Preparation of Waste For Permanent Disposal

The first step in retrieving Hanford's transuranic (TRU) waste for permanent disposal at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, has been initiated more than a year in advance of a TPA milestone that set a September 30, 2000, deadline to begin inspecting and sorting TRU waste containers at Hanford. Waste Management Federal Services of Hanford initiated the first retrieval phase of 1,400 uncovered drums in July, 1999, 14 months ahead of schedule. Waste Management Hanford is a major subcontractor to FDH, which has overall responsibility for managing cleanup of the Hanford Site.

TRU waste consists of trash contaminated with radioactive elements heavier than uranium that are above a specified activity level. All containers holding TRU waste will go through a WIPP certification process before being disposed of permanently at WIPP. Starting the certification process with drums that are uncovered allows the development of a good cost and safety plan to apply to later retrieval campaigns for containers covered with dirt.

The TRU retrieval project was not funded this year, but Waste Management Hanford saved money in other waste-management related

projects to put \$450,000 towards the initiation of the TRU retrieval project. The waste containers could continue to deteriorate if they are left in the dirt-covered storage trenches. Early retrieval will minimize the potential for TRU container failure and avoid the potential for increased treatment costs and safety concerns.

Drums retrieved at Hanford are checked for structural integrity, and the radionuclide content of the drum is determined while still in the trenches. Depending on the concentration of radionuclides, the drums characterized as low-level waste will be reburied in the trenches, while containers determined to be TRU waste will be sent to the Central Waste Complex (CWC) for interim storage.

At CWC, the TRU waste containers will be staged prior to acceptance for processing at the Waste Receiving and Processing (WRAP) Facility. TRU waste will be processed, repackaged for transport, and certified at WRAP before its shipment to WIPP. The first shipment of TRU waste to WIPP is scheduled for the end of FY 1999. This retrieval is the first step in a long-term effort to process, treat, and transport at least 80,000 containers filled with TRU waste off the Hanford Site and out of the State of Washington for final disposal at WIPP.

Canyon Disposition Initiative Project

The Canyon Disposition Initiative (CDI) project is a collaborative project that includes participation across EM. This partnership is driven by the broad and significant impact that decisions made on the disposition of the canyons will have for all these programs.

The CDI project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability to the Environmental Restoration (ER) program. The U Plant facility is being used as a pilot for this evaluation. The RL ER program signed an Agreement-in-Principle (AIP) with the regulators at the beginning of FY 1997 to conduct the evaluation for the disposition alternatives for the canyon facilities. The contents of the AIP were

reviewed with the Hanford Advisory Board (HAB), and a letter of support was received by the HAB for continuing with the evaluation of alternatives.

In 1996, a Canyon Task Team of personnel from RL, the EPA, and the WDOE conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Areas (B Plant, T Plant, U Plant, Plutonium Uranium Extraction Facility, and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

- Alternative 0: No Action
- Alternative 1: Full Removal and Disposal
- Alternative 2: Decontaminate and Leave in Place
- Alternative 3: Entombment with Internal Waste Disposal
- Alternative 4: Entombment with Internal/External Waste Disposal
- Alternative 5: Close in-Place - Standing Structure
- Alternative 6: Close in-Place - Collapsed Structure.

The team also concluded that the CERCLA regulatory process would be the appropriate decision-making pathway.

The CDI project worked with the regulators and shareholders to complete a CERCLA Phase 1 feasibility study that screened potential alternatives to be considered for detailed analysis. Issues that were important to the shareholders were provided to DOE in an issue paper from the ER and Health and Safety/Waste Management committees of the HAB:

- Characterization
- Sources and availability of non-contaminated fill and barrier construction materials
- Detailed structural analysis

- Qualitative groundwater modeling for performance assessment
- Types of waste for disposal.
- Overall impact to the Hanford Site cleanup mission and 200 Area plateau.

The issues provided by the HAB were used as a basis for defining information needs in support of a data quality objective (DQO) process conducted in 1997. The DQO process is a strategic planning approach used to define the criteria that a data collection design should satisfy. The DOE, EPA, and BHI examined why data is needed, the decisions the data will support, and the sampling design required. Results of the DQO supported the development of the sampling and analysis plan (SAP). Characterization data will be collected in accordance with the DQO and SAP and will be used to reach a decision on the disposition of the canyon facilities through the CERCLA process.

The Record of Decision (ROD) for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities.

ENVIRONMENT, SAFETY, AND HEALTH ITEMS FOR MANAGEMENT ATTENTION

Items for management attention were derived from the April 1996 Office of Oversight safety management evaluation and the July 1998 emergency management programs across the DOE complex reports. Items and associated information were written as documented in the DOE complex-wide Corrective Action Tracking System (CATS) and are provided as background. Item status has changed since the evaluation and is given in the Action Status section below the individual item.

RL Oversight of Occupational Health Program

The occupational health program lacks effective direction. Occupational health surveillances are not consistently applied and are not always related to workplace hazards. The absence of RL

performance of line management assessment prevents validation of the sitewide effectiveness of the occupational health program.

Action Status

RL reports that all corrective actions in CATS have been completed.

The contract now requires the contractor to achieve accreditation by the Joint Commission on Accreditation of Health Care Organizations (JCAHO). The effectiveness of the site's occupational health program will be measured by the analysis of EJTA data and population trending of worker health outcomes.

RL and FDH Procedure Quality, Validation, and Adherence

Neither RL nor FDH management has established an environment where the importance of complying with approved procedures is universally understood. Procedure non-compliance results from a number of factors, including poorly written or inadequately validated procedures, lack of acceptance of verbatim adherence to procedures by operating personnel, a level of mistrust in procedures in the field due to known deficiencies, and a verification and validation process that does not always ensure that the correct procedures reach the field.

Action Status

RL reports that all corrective actions in CATS have been completed.

Continued monitoring of ES&H processes, work package quality, and procedural compliance issues are now accomplished by the Facility Evaluation Board (FEB). The FEB provides an independent oversight function for the PHMC that regularly assesses all PHMC facilities and evaluates the facility's performance against established performance objectives and criteria.

DOE and FDH Requirements Management

The absence of clear DOE Headquarters and RL direction to identify applicable safety

management requirements—especially regarding modifications of DOE orders—has led to an inconsistent understanding of what safety requirements are applicable. There is not a comprehensive understanding of the standards/requirements identification documents (S/RIDs) process. The Westinghouse Hanford Company (now FDH) S/RIDs have not captured all applicable requirements and have not been independently evaluated.

Action Status

RL reports that all corrective actions in CATS have been completed.

There have been four reviews; three were independent of the facility/activity. The independent reviews were conducted by the management and integrating contractor, RL line management, and RL independent subject matter expert(s).

DOE and FDH Implementation of Authorization Basis

Authorization basis documents for many Hanford Site facilities—notably PFP, B Plant/WESF, and Tank Farm—that are operated by FDH do not reflect current site hazards, conditions, or activities. DOE (EM, the Headquarters Office of Defense Programs, and RL) have not provided timely reviews of documents. RL has not established the policies and standards for the safety authorization management infrastructure. The FDH safety authorization basis has limited worker safety hazards analysis. Improvements are needed in implementation of the unreviewed safety question process and in control of operational safety requirements.

Action Status

RL reports that all corrective actions in CATS have been completed.

RL and FDH Radiological Work Planning

Weaknesses exist in FDH radiological work planning and in procedural compliance. RL is not providing the necessary radiological control

program direction, and RL has neither developed nor implemented an effective process for evaluating contractor radiological control performance.

Action Status

RL reports that all corrective actions in CATS have been completed.

RL and FDH Monitoring of Safety Management Performance

An integrated approach to comprehensive monitoring and assessment of safety management performance has not been institutionalized at the Hanford Site. There is a general lack of direct participation by RL and contractor line management in monitoring, assessing, and verifying the effectiveness of field activities. Assessment programs are not aggressively used to track, analyze, trend, and improve safety management performance. Performance indicators are used to varying degrees and with varying levels of success by Hanford Site contractor organizations.

Action Status

RL reports that all corrective actions in CATS have been completed.

RL and FDH Implementation of Corrective Action Management

The identification and correction of adverse safety management conditions are not effectively managed at the Hanford Site. RL has not clearly communicated to site contractors the expectations for processing and closing DOE-identified adverse conditions; corrective action management systems lack formality and have not been maintained as site missions, organizations, and management processes have evolved; the process for ranking the risk associated with adverse conditions lacks rigor and is applied inconsistently across site facilities; and corrective action management systems have not had sufficient oversight by RL or FDH.

Action Status

RL reports that three corrective actions in CATS have been completed. Open items are:

1. Revise RL Corrective Action Management System Procedure (RLP 1000.1) to clearly identify the content for RL letters transmitting deficiencies to Hanford contractors; include the criteria for determining whether RL or the contractor is responsible for closing each deficiency. Issue letters of direction to FDH/PHMC to provide direction for processing and closing DOE items.
2. Revise RLP 1000.1 to address changes in how RL does business.
3. The revision of RLP 1000.1 will include a requirement for RL to risk-rank deficiencies requiring corrective action by RL. Since the Quality Assurance order and rule require that conditions that do not meet requirements must be controlled and corrected in accordance with the condition's importance, the contractors have already been provided the direction necessary for prioritizing adverse conditions. There is no basis for having a consistent approach across the four major Hanford contractors; therefore, RL does not intend to provide site contractors further direction on risk-ranking deficiencies.
4. The revision to HNF-PRO-052, "Corrective Action Management," will include changes to the Risk Ranking Value (RRV) Assessment process and associated table. A cross-cutting study from the previously used method of prioritizing deficiencies, known as the Priority Planning Grid (PPG), was performed by a team made up of the PHMC major subcontractors to validate rankings and process.
5. The CAM/DTS Success Criteria have been drafted and presented to RL for review. Formal transmittal of success criteria is targeted for the end of 1999.

Emergency Management Program

Weaknesses in the Hanford emergency management program include timely decision-making (classification and protective actions),

emergency plans and procedures, equipment, training, and public information.

Action Status

RL reports that all corrective actions in CATS have been completed.

RECENT SITE PERFORMANCE**Major Events**Radioactive Waste Removed from High-Heat Storage Tank C-106

A nuclear-waste storage tank that has been a chronic issue at Hanford has finally been emptied of 188,000 gallons of radioactive sludge. As of September 30, 1999, 95 percent of the retrievable waste was transferred from the C-106 SST into a DST. Over the years, the mixture of waste in the tank has generated heat to reach a temperature as high as 235 F and sometimes raised fears about tank failure. Leakage into groundwater was also a concern as the tank continued to age and deteriorate. This is the first completed retrieval of radioactive waste from an SST at Hanford. This operation proved that wastes can be removed from the SSTs, and also helps to provide solutions to some of the technical difficulties surrounding future retrieval operations at other tanks. The C-106 sluicing project involved an integrated team of contractors and DOE personnel, including scientific, engineering, operational, maintenance, safety, industrial hygiene, radiological, and business management personnel, as well as other support.

FDH Solicits Proposals To Manage Facility Stabilization

On September 17, 1999, FDH announced that it will solicit technical proposals for the management of portions of the facility stabilization program. BWHC currently manages the project. Facility stabilization activities at the DOE's former nuclear materials production site include stabilizing the PFP, cleaning up the 324/327 Laboratory facilities,

and maintaining the FFTF in a standby mode while the DOE determines its future.

The competition will focus on seeking overall improved performance, including addressing stakeholder and regulatory concerns. FDH has been reviewing alternative approaches for completing this work and has received informal expressions of interest from companies with excellent expertise in nuclear facilities and materials.

BWHC is an original member of the FDH team, which began work at Hanford in October 1996. Following the original two-year term, BWHC received a one-year extension to its contract, which runs through the end of 1999.

Results of Major Recent Assessments

Hanford Tank Farms ISMS Implementation

Energy Secretary Bill Richardson has directed that all DOE sites must have an integrated safety management system (ISMS) that is an integral

part of the work process in place and verified by September 2000.

The Hanford TWRS operation has been declared to be ready to implement ISMS. In a report, the verification team repeatedly commends worker and management involvement in ensuring safe work practices at the Hanford tank farms, which LMHC operates for ORP under a subcontract with FDH.

ISMS is implemented through a two-phase process. The tank farms project completed the Phase I review in the fall of 1998. The tank farms Phase II review was completed in mid-August 1999, and the report was issued on August 18, 1999. Opportunities for improvement contained in these reports have been catalogued in DOE and contractor corrective action plans (CAPs) and are being tracked to closure. Actions needed to establish ORP and its contractors as separate entities, including having separate ISMS system descriptions and appropriate separate contract language, are in progress or have been completed.

Appendix A. Key Facility Summary

FACILITY NAME	MISSION/ STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPAL HAZARDS AND VULNERABILITIES
222S Laboratory Complex	Mission: Sample analysis of high-activity radioactive and mixed waste. Status: Operational	Category (Cat) 3 facility; 222-S Interim Safety Basis (ISB), HNF-SD-CP-ISB-002, Rev. 2, dated January 28, 1997	0.25g earthquake with fire induced failure of main lab structure; offsite dose = 0.011 rem; onsite dose = 24 rem	Risks from radiation, radioactive contamination, asbestos, and laboratory quantities of hazardous chemicals. Facility does not meet seismic standards and some maintenance backlog exists. RL performs routine audits, surveillances, and annual DOE Order 5480.19 conduct of operations assessments. DOE Order 5480.23 SAR scheduled for completion in 2001.
324 Bldg., Waste Technology Engineering Laboratory	Mission: High-level chemical processing and metallurgical engineering studies. Status: Operational	Cat 2 facility; 1996 OSRs - PNL-LIM-324; 1996 SAR - PNL-SAR-324	<u>Major Fire Enriched Uranium (EU)</u> Total onsite unmitigated dose = 63 rem effective dose equivalent (EDE); Total offsite unmitigated dose = 16 rem EDE <u>Seismic (EU)</u> Total onsite unmitigated dose = 69 rem EDE; Total offsite unmitigated dose = 14 rem EDE	Hot cell, glovebox, fume hood, and benchtop R&D activities with multi-curie inventories of radioactive materials and small quantities of chemicals that do not exceed threshold quantities (TQs) in 29 CFR Part 1910.119, Process Safety Management of Hazardous Chemicals. Significant quantities of radioactive material in the Shielded Material Facility (SMF) cells and the Radiological Engineering (RE) cells. Protective measures and multiple barriers are in place to mitigate these hazards. Audits and appraisals have not identified significant issues.
PUREX Plant	Mission: Pu/U separations. Status: Surveillance & maintenance	Cat 3 facility; 1990 SAR and 1993 Risk Acceptance Guidelines for Use in DOE Facilities	N Cell criticality; onsite dose > 450 rem (5 persons); offsite dose = 3 mrem	Significant residual special nuclear material and fission products in canyon cells prohibit worker entry. Confined spaces, falls from deteriorating building roofs, and old electrical wiring present serious safety exposures.
327 Bldg.	Mission: Destructive and nondestructive testing of irradiated materials. Status: Operational	Cat 2 facility; 1995 SAR PNL-SAR-327 1995 OSRs PNL-LIM-327	Pin rupture with fire in shielded cell; onsite dose = 15 rem; offsite dose = 1.5 rem; same doses from capsule or pin breach during transfer	Hazardous chemicals (e.g., acids, ammonia, hydrogen peroxide). Potential for exposure from direct radiation, radioactive contamination, and chemicals. Facility does not have refrigerated air conditioning and does not meet present electrical codes. The facility lacks a modern safety design.

Appendix A. Key Facility Summary (cont'd)

FACILITY NAME	MISSION/ STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPAL HAZARDS AND VULNERABILITIES
B-Plant and Waste Encapsul'n Storage Facility (WESF)	<p>Mission: Chemical separations (deactivated), conversion of Sr-90 and Cs-137 solutions to stable forms, water basin storage of capsules.</p> <p>Status: WESF operational; transitioned to stand alone facility. B-Plant in transition to deactivation</p>	Cat 2 facility; B-Plant - 1986 SAR; Interim Safety Basis submitted 3/96 to RL; WESF - 1988 SAR; ISB in process	0.12g seismic event and organics fire in B Plant Canyon with B Plant HEPA filter damage; offsite dose = 0.09 rem; onsite dose = 237 rem	Potential for radiological contamination, high-energy steam, and electric shock. Exhaust ventilation systems depend upon power operators' knowledge. Potential for WESF capsules to leak; capsule contact dose is 500,000 to 750,000 rads/hr. Leak detection system will not identify location of leaking capsule. If leak occurs, 500,000 gallons of contaminated pool water must be replenished.
Fast Flux Test Facility	<p>Mission: 400 MW test reactor.</p> <p>Status: The reactor is defueled, Heat Transport System maintained at 380 to 420 F</p>	Cat 2 facility; 1975 SAR with 73 amendments; SAR being revised to reflect shutdown status	Loss of all offsite and onsite power except Class 1E battery supply; forced coolant circulation ceases; reactor head seals leak; onsite dose rate in containment = 1.26 rem/hr; offsite dose at site boundary = 0.7 mrem; 10 CFR 100 guidelines not exceeded	Radiological vulnerabilities common to a nuclear power plant and exposures to sodium, nitrogen atmospheres in cells containing sodium, and industrial hazards. Facility has performed excellently, with few significant events.
K Basins	<p>Mission: Storage of irradiated spent fuel.</p> <p>Status: Operational</p>	Cat 2 facility; 1984 SAR with 9/94 approved update; latest update approved, 9/98; with three latest updates through 7/98. New SAR and technical safety requirement (TSR) planned for 6/99	A fully loaded transfer cask dropped accidentally on to the floor of the transfer area from a height of 15 feet or more and overturning would result in the cask lid coming off and irradiated fuel spilling out of the cask. EDE to the offsite population would be 0.015 rem EDE. EDE to workers would be well within 5 rem.	Radiological vulnerabilities, possible criticality events, and industrial hazards. Much of the fuel is in a degraded condition; radionuclides have been released to K East Basin cooling water and distributed as sludge. K East Basin has leaked to the soil in the past, potentially contaminating soil and groundwater. Samples from monitoring wells confirm that groundwater is contaminated with tritium; some wells have concentrations orders of magnitude greater than regulatory limits. Contaminated groundwater is likely entering the Columbia River. Potential for radionuclide releases to air from basin water. Facility does not meet current safety and quality standards. Facility high priority with DNFSB; the public's number one priority.

Appendix A. Key Facility Summary (cont'd)

FACILITY NAME	MISSION/ STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPAL HAZARDS AND VULNERABILITIES
Plutonium Finishing Plant (PFP)	Mission: Pu processing, handling, storage, and support operations. Status: Operational	Cat 2 facility; 1/95 SAR	Low probability seismic event with loss of ventilation, concurrent criticality, and fire; onsite dose = 21.1 rem; offsite dose = 0.475 rem	Risks from exposure to plutonium and other transuranics. Accident analyses identify several accident scenarios that could cause significant damage to the environment (e.g., fire, earthquake, explosions). Backlog of 220 corrective maintenance orders; 180 are more than 90 days late. With the exception of safety systems, the facility "as built" drawings do not reflect current conditions. One RL assessment identified 45 findings; 16 had an unusually high safety significance, and 8 corrective actions for the findings are delinquent.
Tank Farms (TWRS)	Mission: Storage of high-level waste from weapons production and decontamination operations. Status: Operational	Cat 2 facility; TWRS BIO/TSRs and a series of project/facility safety documents. Final SAR approved.	Organic-nitrate fire "extremely unlikely". Onsite dose (mitigated) = 8,800 rem. Offsite dose (mitigated) = 7.3 rem. Frequency of occurrence for both = 10^{-5} .	Radiological hazards, toxic chemical hazards, and industrial hazards. Many SSTs leak to ground, contaminating the immediate environment. Tanks are not designed to modern seismic standards; there is no redundancy in essential systems. Earthquake damage to tanks could have catastrophic consequences, releasing radionuclides and hazardous chemicals to air and ground. Some chemicals in the tanks are capable of causing fire or explosions, potentially releasing hazardous waste to air and ground.
T Plant	Mission: High-activity and low-activity decontamination and repair. Status: Operational	Cat 3 facility; 1993 SAR, Rev 1, with 10/95 ISB issued 12/96. SAR being prepared.	T Canyon piping spray release process fluid; onsite dose EDE = 2.32 rem; offsite dose EDE = 39 mrem; extremely unlikely event	Risks from exposure to radiation, various chemicals, metal fumes (welding), and toxic dusts (silica sand). 221-T and 271-T designed and built to 1944 codes having no seismic provisions and no requirements for tornado resistance. 221-T and 271-T would survive a tornado. Seismic design analysis of 221-T indicates that extensive damage would occur to the structure, but canyon walls would not collapse and the decontamination cells would maintain integrity.

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